

Method and apparatus to the preparation extruded, cavities exhibiting, ceramic moulded product

The invention relates to a method to the preparation extruded, cavities exhibiting ceramic moulded product in accordance with the generic term of the claim 1 and an apparatus to the lead-through of the method in accordance with the generic term of the claim 5.

With the preparation of ceramic moulded products with channels in the extruding procedure from a flexible mass (DE-OS 24 21 311) frequently the promoting is placed to form as thin-walled a bodies as possible. The border is determined by the deformation arising under dead weight of the fresh extruded ceramic molded article blank with extruding and with supports immediately after the extrusion, if the weight of the moulded product will transfer to its structure. If the ceramic mass is too soft and/or if the walls are too thin, the spatial form produced by the extrusion cannot be maintained. The moulded products collapse or distort themselves in such a manner that they become useless. For example this problem arises with the preparation of ceramic moulded products honeycomb structure, which serve as catalyst supports. Such honeycomb bodies exhibit a multiplicity from next to each other arranged, in particular parallel running, continuous channels, which are formed from bar-like cell walls and by these cell walls from each other divided are.

Such so-called honeycomb catalysts are used in particular for the distance of nitrogen oxides from exhaust gases with ammonia gas (see. z. B. DE-PS 26 58 539). The well-known honeycomb catalysts are in such a manner optimized regarding their spatial form that the open frontal surface formed from the channels corresponds with the hydraulic diameter of the channels and the exhaust speed, so that a blockage of the channels is avoided by carbon black and/or dust and the Denitrierung a maximum value reach can. Als Grenzwert für die offene Frontalfläche ist bisher ein Wert von 80 % festgestellt worden, weil bei Überschreitung dieses Wertes die aus dem keramischen Werkstoff bestehenden Zellenwände zwischen zwei benachbarten Kanälen keine ausreichende mechanische Festigkeit mehr aufweisen würden. Der Grenzwert für die offene Frontalfläche bedeutet eine Einschränkung bezüglich der Abgasgeschwindigkeit und des hydraulischen Durchmessers der Kanäle und damit bezüglich der Leistung des Wabenkatalysators.

After a new suggestion honeycomb catalysts were manufactured, whose open frontal surface is more than 80% of the entire frontal surface, whereby the mechanical strength of the cell walls is sufficiently high and all demands made against the moulded products are fulfilled. A substantial problem is to ensure with the fact that freshly the strand withdrawing from the nozzle of the extrusion press is in such a way treated that it does not distort itself. This problem e.g. steps not only with honeycomb catalysts, but. also with thin-walled multi-hole pipes, hollow bodies with thin-walled profile such as special hollow bricks and catalyst supports for chemical processes with e.g. star and/or speichenförmigen cross sections up.

One can by burning a ceramic mass and special measures, which on the structural strength of the angesteiften and burned ceramic Scherbens influences, a sufficient piece of broken glass firmness also still with very thin walls ensure, must however with the shaping consider that the flexible ceramic mass under dead weight of the moulded

product can be distorted with its extruding and storing. Insofern kann eine Optimierung der Scherbenfestigkeit ins Leere gehen.

Flexible ceramic dimensions is usually so developed that it at the time of the shaping optimal plastic and/or. flexible and after the shaping if possible quick is on steif, so that the moulded product is manageable after short time. Before the Ansteifen and/or. Reach the so-called becoming green A FIRMNESS exhibits the moulded product only the small strength, which lends the flexible soft mass to it. So that none arise by dead weight caused deformations, one had to plan so far dimensions of the moulded product, which are not at all necessary for the moulded product after the Ansteifen and burning.

Task of the invention is to create a method and an apparatus initially in each case of the kind mentioned with that and/or. with the moulded products with still thinner walls than it so far was possible and with exact dimensions are producible.

This task becomes by in the characteristic part of the claim 1 and/or. 5 indicated features solved. In the Unteransprüchen favourable embodiments of the invention are characterized.

On the basis the example represented in the design the invention is more near described in the following.

Show:

Fig. 1 a perspective opinion of an apparatus to the preparation of extruded moulded products,

Fig. 2 einen Schnitt entlang der Linie II-II in Fig. 1,

Fig. 3 perspectively a honeycomb catalyst,

Fig. 4 einen Ausschnitt aus einer Frontalfläche des Wabenkatalysators.

Eine Vorrichtung zur Herstellung stranggepresster, Hohlräume aufweisender keramischer Formkörper weist neben anderen bekannten üblichen Einrichtungen eine Strangpresse auf, von der in Fig. 1 lediglich der Auslauf 5 mit dem Mundstück 6 abgebildet ist. The nozzle 6 is rectangular and points slots 7, which, crossing, are so arranged that square island bars 8 between the slots remain. It is substantial that the nozzle is arranged of 6 with one its points 9 rising up perpendicularly downward. The extrusion press a trough follows 10, which positioned two V-shaped to each other inner walls 11 and 12 exhibits and 13 in the trough 10 forms a longitudinal fold, which is because of the deepest place of the trough. The trough e.g. stores. with supports 15 on a plate 14.

The trough 10 is in such a way placed before the nozzle that the point 9 of the mouthpiece 6 something above the longitudinal fold 13 and the trough 10 are positioned even in strand direction of motion extending.

The inner walls 11 and 12 of the trough 10 exhibit numerous small openings 16 and are a component of an hollow body with external walls 17 and longitudinal edge walls 18 as well as transverse edge walls 19. At least one external wall 17 is equipped with a connective opening 20 for the terminal of an air line 21.

In the trough 10 stores fresh, more cut to length moulded products square in the cross section 22 suspended on an air cushion. The air cushion is formed by compressed air, which becomes by the piping 21 and 21 A into the cavity 23 of the gutter hollow body printed. The arrows 24 clarify that air withdraws from the openings 16 of the inner walls 11, 12 and forms under the outer surfaces 25, 26 of the moulded product 22 an air

cushion, its thickness is dependent of the dead weight of the moulded product and the dynamic pressure of air withdrawing from the openings 16. The moulded product 22 is stored thereby in the trough suspended.

The spatial form of the inner walls 11, 12 is so trained appropriately that the moulded product will equidistantly surround 22 at the outer surfaces 25, 26, which is called that the air cushion everywhere the same thickness has. This applies also to other spatial forms of the moulded products. The invention points thus a way out, how, ceramic blank with as thin a walls as possible can be more freshly stored, without he collapses with the bearing immediately after the extrusion under the effect of the dead weight and/or. durch sein Eigengewicht deformiert wird.

Nach der Erfindung werden die durch das Eigengewicht bei der Lagerung erzeugten Reaktionskräfte so auf die Aussenwandungen des Formkörpers verteilt, dass die geringstmögliche Flächenpressung auftritt. With one in the cross section moulded products round the trough would be cylindric trained and the moulded product at least on a cylinder half would surround. Everything between a square and a round and/or. oval moulded product lying possible shaping can be stored with an accordingly formed trough on an air cushion, which surrounds the moulded product preferably hälftig, i.e. if possible half of his lateral surface affects. The storage of the moulded product on the air cushion takes place until the mass is sufficiently angesteift and can easily be handled. For this purpose the trough (10) can be arbitrarily long; it can be divided into different segments, in which air can be given up independently. Beyond that air in the individual segments with different quantities, temperatures, pressures and Geschwindigkeiten can be given up. The strand withdrawing from the nozzle 6 is pushed directly onto the air cushion, on which it is non-contact put forward. To that extent also no friction forces can occur, which can lead to deformations.

The method according to invention and the apparatus according to invention are in particular applicable, and/or. to the preparation of honeycomb catalysts, their open frontal surface more than 80% of the entire frontal surface is usable and preferably between 80 and 90% lies and the cell wall thicknesses preferably exhibits between 0,6 and 1,2 mm. These honeycomb bodies can be trained also in the cross section square channels, whereby the relationship between the wall thickness and the edge length preferably 1: 7 to 1: 14, in particular 1: 8 to 1: 12, amounts to. The honeycomb bodies are trained in the cross section preferably rectangular and preferably 300 to 1200 mm or even up to 2000 mm long and exhibit an edge length from preferably 100 to 300 mm. For example the honeycomb bodies consist of Cordierit and/or Mullit and/or stoneware and/or aluminium oxide and carry on the surfaces and/or contain in pieces of broken glass a catalytic effective material.

With the making of such honeycomb catalysts the components of the ceramic mass are used on grain size under 0.18 mm to grind or according to fine raw materials. In addition an unusually high flexibility value of the mass is stopped after pepper grain between 25 and 27. With such thin walls from 0,4 to 1.2 mm, preferably 0.5 to 0.8 mm of thickness extruded relatively large honeycomb body blank with lengths of over 1000 mm and cross-section areas over 100 cm² is very heavy and cannot with conventional compositions not without danger caused by deformations, in particular by dead weight, stored and/or. are transported.

After the invention an air cushion is used, which surrounds a moulded product on two neighbouring sides, preferably full-laminar, square in the cross section, whereby the moulded product, pointing with a longitudinal fold, stores perpendicularly downward on the air cushion suspended. Bei einem runden Formkörper wird vorzugsweise ein Luftkissen verwendet, das, den Formkörper im Querschnitt betrachtet, mindestens einen Viertelkreisbogen bis zu einem Halbkreisbogen umgibt. Die Luftkissenfläche wird in jedem Fall so gross gewählt, dass der aus der Presse fliessende Strang getragen wird, ohne dass Deformationen am Formkörper auftreten, d.h. the weight of the moulded product is distributed on as large a cushion area as possible. For the production of the air cushion according to the moulded product dimensioned and spatial form-moderately adapted trough is preferably used, which exhibits a smooth, punched surface, preferably made of metal, whereby compressed by the holes air becomes into the trough. The gutter surface is in such a way laid out that it surrounds at least a part of the lower surfaces of the moulded product and an air cushion by approximately 0.1 to 3 mm between the wall of the trough and the Aussenwandung surfaces of the moulded product one forms. Preferably the thickness of the air cushion amounts to about 1 to 1.5 mm.

If in the cross section of square moulded products, rising up with a longitudinal fold downward, one stores, the dead weight is distributed on the air cushion on two sides, so that also moulded products can be stored, if they store on a surface and/or ihr Gewicht auf nur einer Fläche wirksam würde, in sich zusammensacken würden. Die gleiche Wirkung der Gewichtsverteilung ergibt sich bei der beschriebenen Unterstützung eines im Querschnitt runden oder ovalen instabilen Wabenkörpers mit einem Luftkissen. Is favourable, the external wall of a moulded product somewhat more thickly to design than the cell walls. Zweckmässig ist ein Verhältnis der Dicke der Aussenwandung zur Dicke der Zellenwandungen von 1,05 : 2,5.

Ein keramischer Formkörper, der nach dem erfindungsgemässen Verfahren mit der erfindungsgemässen Vorrichtung herstellbar ist, ist in den Fig. 3 und 4 abgebildet. Der in Fig. 3 gezeigte viereckige Formkörper 1 enthält eine Vielzahl von Kanälen 2 von quadratischem Querschnitt, die durch Zellenwände 3 voneinander getrennt sind. The moulded product has an outside wall 4. The length l can amount to up to 2000 mm. The outside dimensions m and n of such a moulded product can amount to 100 to 300 mm. The moulded products are provided with a catalyst substance. They can be contained in pieces of broken glass a catalytic working material and/or be coated or soaked after burning the Scherbens. They are arranged next to each other as well as in the spacing one behind the other for example in a larger number in a flue gas stream, so that environmentalharmful materials can be converted into innocuous materials.

In Fig. the wall thickness k of the walls 3 between the channels 2 and the edge length q of the preferably square channels shows 4 represented cutout from the frontal surface of a honeycomb catalyst 1. The relationship k: q can do according to invention 1: 7 to 1: 14 betragen. The outside walls 4 are implemented more thickly than the cell walls 3.

With about right-angled crossing internal cell walls the extruding takes place itself on in the trough under the moulded product the screen end air cushion via a nozzle in a position, with which the internal cell walls with the perpendicular centre plane of the trough in each case form an angle of approximately 45 DEG. Thereby obviously the forces resulting in from the dead weight of the mass distribute themselves laterally to the side walls of the moulded product supported by the air cushion and a deformation is

avoided both the internal, very thin cell walls and the not supported upper external walls. In Fig. 1 represented arrangement of the slots 7 of the nozzle 6 for the formation of internal cell walls 3 (Fig. 4) therefore also one prefers if the external form of the moulded product is not square.

Between the lower outer surfaces, but also a drying and cooling of these outer surfaces coated by air does not made only favour themselves 25, 26 of the moulded product 22 and the inner walls 11, 12 of the trough developing air cushions possible contactless feed motion and storage of a not yet sufficiently angesteiften moulded product 22.

Die Länge der Rinne 10 kann so gewählt sein, dass in ihr mehrere nacheinander extrudierte Formkörper 22 gelagert bzw. to be shifted further can. For a careful delivery of the moulded products 22 can do at least the portion or segment of the channel carrying at most angesteiften moulded product 10 around one parallel to the longitudinal fold 13 e.g. at the plate 14 arranged axle 29 tiltable its. To the delivery on the upper sides of the moulded product 22 a rinnenförmiges stretcher sheet metal is presented. By swivelling the trough or the segment around approximately 180 DEG the still sensitive moulded product is downward handed over on the not represented stretcher sheet metal and can be brought on that to drying.